

## CLAIMS

1. A method of delaminating aggregated particles of natural silicate, nanoplatelet, nanofiber, or nanotube structures, the method comprising:  
diffusing a coating agent in a substantially supercritical fluid between the aggregated particles; and  
catastrophically depressurizing the substantially supercritical fluid to form delaminated particles.
2. The method of Claim 1 further comprising processing the delaminated particles with a polymer to form delaminated particle-polymer nanocomposites.
3. The method of claim 2 wherein processing the delaminated particles with the polymer includes extruding, molding, melt mixing, solution casting, compounding, fiber spinning, supercritical fluid processing or combinations thereof.
4. The method of Claim 1 wherein the coating agent comprises a polymer, an oligomer, a monomer, or an oil or a mixture thereof.
5. The method of Claim 2 wherein the polymer is a miscible or immiscible polymer relative to the coating agent.
6. The method of Claim 1 wherein the substantially supercritical fluid comprises carbon dioxide, methane, ethane, nitrogen, argon, nitrous oxide, alkyl alcohols, ethylene propylene, propane, pentane, benzene, pyridine, water, ethyl alcohol, methyl alcohol, ammonia, sulfur hexafluoride, hexafluoroethane, fluoroform, chlorotrifluoromethane, or mixtures thereof.
7. The method of Claim 1 further comprising applying an external field to orient the delaminated particles.

8. The method of Claim 7 wherein applying the external field includes shear flowing, extensional flowing, mechanical procuring, electrical field procuring, or magnetic field procuring.

9. The method of Claim 8 wherein applying the external field includes orienting the delaminated particles in an uniaxial or multiaxial flow.

10. The method of Claim 1 wherein the aggregated particles are in the form of powder with an average aggregated size of between about 2 nanometer and 1 millimeter.

11. The method of Claim 1 wherein diffusing the substantially supercritical fluid and the aggregated particles is performed for a time between about 10 minutes to 24 hours.

12. The method of Claim 1 wherein catastrophically depressurizing the contacted particles is performed in between about 5 and 30 seconds.

13. The method of Claim 1 wherein catastrophically depressurizing the contacted particles comprises exfoliating the contacted particles and reducing reaggregation of the structures.

14. The method of claim 1 the weight ratio of the aggregated particles to the coating agent is at least about 1:0.1

15. A method of preparing a reinforced polymer, the method comprising:  
diffusing a coating agent in a substantially supercritical fluid between aggregated particles of silicate, nanoplatelet, nanofiber, or nanotube structures defining contacted particles;  
catastrophically depressurizing the substantially supercritical fluid to form delaminated particles; and

processing the delaminated particles with a polymer to form delaminated particle-polymer nanocomposites defining the reinforced polymer.

16. A method of preparing a reinforced polymer, the method comprising:
- diffusing aggregated particles of a silicate, nanoplatelet, nanofiber, or nanotube structures with a coating agent solubilized in a substantially supercritical fluid to intercalate the coating agent between the aggregated particles defining contacted particles;
  - catastrophically depressurizing the contacted particles to exfoliate the contacted particles and reduce reaggregation of the structures, the coating agent being precipitated from the substantially supercritical fluid and deposited on the contacted particles during depressurization defining delaminated particles; and
  - processing the delaminated particles with a miscible polymer or an immiscible polymer to form delaminated particle-polymer nanocomposites defining the reinforced polymer.

17. The method of Claim 16 further comprising applying an external field to orient the delaminated particles.

18. A method of preparing a reinforced polymer, the method comprising:
- diffusing aggregated particles of a silicate, nanoplatelet, nanofiber, or nanotube structures with a coating agent solubilized in a substantially supercritical fluid to intercalate the coating agent between the aggregated particles defining contacted particles;
  - catastrophically depressurizing the contacted particles to exfoliate the contacted particles and reduce reaggregation of the structures, the coating agent being precipitated from the depressurized fluid and deposited on the contacted particles during depressurization, defining delaminated particles;
  - processing the delaminated particles with one of a miscible polymer or an immiscible polymer to form delaminated particle-polymer nanocomposites; and

applying an external field to orient the delaminated particles in the film, fiber, molded parts, defining the reinforced polymer.

19. A delaminated silicate, nanoplatelet, nanofiber, or nanotube structure coated with a coating agent and substantially singly dispersed apart from each other.

20. A delaminated particle-polymer nanocomposite comprising delaminated particles of silicate, nanoplatelet, nanofiber, or nanotube structures coated with a coating agent and dispersed in a polymer.